

Xiaoyi Liu

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Education

PhD , Civil and Environmental Engineering , Stanford University	Sep 2007 – Jun 2011
MS , Geoscience, University of Iowa	Aug 2004 – Dec 2006
BS , Earth Sciences, Nanjing University, China	Aug 1998 – Jul 2002

Research Experience

Earth Science Division, Lawrence Berkeley National Laboratory Jul 2011 - present

Postdoctoral Research Fellow

Geologic CO₂ storage in the deep subsurface such as depleted oil reservoirs, with focuses on

- effects of heterogeneity on the dynamics of CO₂ and brine in porous media;
- large-scale stochastic inverse modeling and leakage pathway detection for CO₂ storage sites;
- assimilation of multi-physics and multi-scale measurements for subsurface characterization; and
- effective uncertainty quantification and monitoring network optimization.

Environmental Fluid Mechanics & Hydrology, Stanford University Sep 2007 – Jun 2011

Graduate Research Assistant

Conducted research on subsurface imaging, model calibration, remediation optimization and value of information in groundwater and environmental problems. More specifically, my research included:

- subsurface imaging and large-scale stochastic inverse modeling;
- parameter estimation for nonlinear environmental problems;
- cost-optimization of groundwater remediation under uncertainty;
- value of information in environmental remediation; and
- environmental decision analysis.

Iowa Institute of Hydraulic Research, University of Iowa Aug 2004 - Aug 2007

Graduate Research Assistant

Conducted award-winning research on subsurface imaging with validation, at lab scale (sandbox) and field scale (Mizunami Underground Research Site), with both hydraulic data (hydraulic tomography) and tracer data (partitioning/non-partitioning tracer tomography); and set up and maintained a high performance computing (HPC) cluster for the group.

Research Projects

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1. ESD Early Career Development Grant, \$40K, 2012-2013, **PI**
 2. Joint inversion of Monitoring Data for Early Leakage Detection, USDOE, 2011-2013, participant
 3. Subsurface Imaging and Uncertainty Quantification (DMS-0934596), NSF, 2010-2011, participant
 4. Practical Cost-Optimization of Characterization and Remediation Decisions at DNAPL Sites with Consideration of Prediction Uncertainty (ER-1611), SERDP, 2008-2011, participant;

Teaching Experience

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1. *Computations in Civil and Environmental Engineering*, Stanford, fall 2007 & 2008, graduate/undergraduate, class size: 25-45
 2. *Groundwater Flow*, Stanford, winter 2008, graduate, class size: 15
 3. *Engineering Geology*, Iowa, spring 2007, undergraduate/graduate, class size: 70
 4. *High school math and English*, Lhasa Beijing High School, Tibet, 2002-2003, class size: 50-70

Services

Conferences	Co-convended and chaired three sessions for the 2006 Western Pacific Geophysics Meeting (WPGM) held by American Geophysical Union (AGU).
Journal Reviewer	Was invited to review manuscripts for the following journals: <i>Environmental Science & Technology</i> ; <i>Water Resources Research</i> ; <i>Advances in Water Resources</i> ; <i>Journal of Hydrology</i> ; <i>Ground Water</i> ; <i>Stochastic Environmental Research and Risk Assessment</i> , <i>Hydrogeology Journal</i> , etc.

Awards

Chinese Government Award for Outstanding Students Abroad, China Scholarship Council, 2010
Outstanding Student Paper Award for 2005 Fall Meeting, AGU, 2006
Renmin Scholarship, Nanjing University, two consecutive years, 2001-2002
Bangheng Scholarship, Nanjing University, 2000
China Merchants Bank Scholarship, Nanjing University, 1999

Memberships & Certificates

Engineer-in-Training (EIT), National Council of Examiners for Engineering and Surveying (NCEES), 2011-
American Geophysical Union (AGU), 2005-
Society of Actuaries (SOA), 2007-

Publication

Theses

3. **Xiaoyi Liu**, Estimation, Optimization and Value of Information in Groundwater Remediation, *PhD Thesis*, Stanford University, 2011;
2. **Xiaoyi Liu**, Laboratory Sandbox Validation of Steady State and Transient Hydraulic Tomography, *Master Thesis*, the University of Iowa, 2006;
1. **Xiaoyi Liu**, Modeling of Groundwater Flow of An Idealized Case Using Finite Element Method, *Bachelor Thesis*, Nanjing University, 2002;

Journal Papers (H-Index: 5)

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18. **Xiaoyi Liu** and Peter K. Kitanidis (2012), Parameter Estimation in Environmental Problems with Truncated Measurements, *manuscript in preparation*;
 17. **Xiaoyi Liu** and Peter K. Kitanidis (2012), Structural Parameter Estimation in Large-Scale Inverse Modeling, *manuscript in preparation*;
 16. **Xiaoyi Liu** and Peter K. Kitanidis (2012), Large-Scale Bayesian Inverse Modeling with Fast Iterative Solver, *manuscript in preparation*;
 15. **Xiaoyi Liu**, Jonghyun Lee, and Peter K. Kitanidis (2012), Second-Order Asymptotic Estimation of the Value of Information in Groundwater Remediation, *manuscript in preparation*;
 14. Jack Parker, Ungtae Kim, Peter Kitanidis, Mike Cardiff, **Xiaoyi Liu**, and Greg Beyke (2012), Stochastic Cost Optimization of DNAPL Site Remediation: I. Method Description and Sensitivity Studies, *under review*;
 13. Ungtae Kim, Jack Parker, Peter Kitanidis, Mike Cardiff, **Xiaoyi Liu**, and James Gillie (2012),

Stochastic Cost Optimization of DNAPL Site Remediation: II. Field Application, *under review*;

12. **Xiaoyi Liu**, Jonghyun Lee, Peter K. Kitanidis, Jack Parker, and Ungtae Kim (2012) ,Value of Information as a Context-Specific Measure of Uncertainty in Groundwater Remediation, *Water Resources Management*, Volume 26, Issue 6, 1513-1535; times cited: **1**;

11. Jonghyun Lee, **Xiaoyi Liu**, Peter K. Kitanidis, Jack Parker, and Ungtae Kim (2012), Cost optimization of DNAPL Remediation at Dover Air Force Base Site, *Ground Water Monitoring & Remediation*, DOI: 10.1111/j.1745-6592.2011.01382.x, times cited: **2**;

10. **Xiaoyi Liu**, and Peter K. Kitanidis (2011), Large-Scale Inverse Modeling with an Application in Hydraulic Tomography, *Water Resources Research*, 47, W02501, times cited: **5**;

9. Walter A. Illman, Steven J. Berg, **Xiaoyi Liu**, Andrew J. Craig, and Antonio Massi (2010), Hydraulic/Partitioning Tracer Tomography for DNAPL Source Zone Characterization: Small-Scale Sandbox Experiments, *Environmental Science & Technology*, 44 (22): 8609-861, times cited: **2**;

8. **Xiaoyi Liu**, Michael Cardiff, and Peter K. Kitanidis (2010), Parameter Estimation in Nonlinear Environmental Problems, *Stochastic Environmental Research and Risk Assessment*, Volume 24, Number 7, 1003-1022, times cited: **6**;

7. Jack Parker, Ungtae Kim, Peter K. Kitanidis, Michael Cardiff and **Xiaoyi Liu** (2010), Stochastic Cost Optimization of Multi-Strategy DNAPL Site Remediation, *Ground Water Monitoring & Remediation*, Volume 30, Number 3, pp. 65-78(14), times cited: **2**;

6. Michael Cardiff, **Xiaoyi Liu**, Peter K. Kitanidis, Jack Parker, and Ungtae Kim (2010), Cost Optimization of DNAPL Source and Plume Remediation Under Uncertainty Using a Semi-Analytic Model, *Journal of Contaminant Hydrology*, Vol 113, Issues 1-4, pp. 25-43, times cited: **3**;

5. Illman, W. A., **X. Liu**, S. Takeuchi, T.-C. J. Yeh, K. Ando, and H. Saegusa (2009), Hydraulic tomography in fractured granite: Mizunami Underground Research site, Japan, *Water Resour. Res.*, 45, W01406, times cited: **22**;

4. Illman, W. A., **X. Liu**, and A. J. Craig (2008), Evaluation of Transient Hydraulic Tomography and Common Hydraulic Characterization Approaches Through Laboratory Sandbox Experiments, *Journal of Environmental Engineering and Management*, Vol. 18, No.4, pp. 249-256;

3. Walter A. Illman, Andrew Craig, and **Xiaoyi Liu** (2008), Practical Issues in Imaging Hydraulic Conductivity through Hydraulic Tomography, *Groud Water*, 46,120-132, times cited: **21**;

2. Walter A. Illman, **Xiaoyi Liu**, and Andrew Craig (2007), Steady-State Hydraulic Tomography in a Laboratory Aquifer with Deterministic Heterogeneity: Multi-Method and Multiscale Validation of Hydraulic Conductivity Tomograms. *Journal of Hydrology*, 341, 222-234, times cited: **28**;

1. **Liu, X.**, W. A. Illman, A. J. Craig, J. Zhu, and T.-C. J. Yeh (2007), Laboratory Sandbox Validation of Transient Hydraulic Tomography, *Water Resour. Res.*, 43, W05404, times cited: **34**;

Conference Presentations

Xiaoyi Liu, Jonghyun Lee, Peter K Kitanidis, Jack Parker, and Ungtae Kim, Context-Specific Measures of Uncertainty in Groundwater Remediation, *AGU Fall Meeting 2010*, speak

Xiaoyi Liu, and Peter K. Kitanidis, Large-scale inverse modeling with an Application in hydraulic tomography, *AGU Fall meeting 2009*, poster

Xiaoyi Liu, M. Cardiff, J. Parker, P. Kitanidis, NAPL remediation cost optimization under uncertainty using a semi-analytic model, *AGU Fall meeting 2008*, poster

Xiaoyi Liu, Walter A. Illman, and Andrew J. Craig, Hydraulic and tracer tomography for the

characterization of DNAPL source zones: A laboratory sandbox study, *AGU Joint Assembly 2007*, speak;

Illman, W. A., **X. Liu**, S. Takeuchi, T.-C. J. Yeh, K. Ando, and H. Saegusa, Hydraulic Tomography in Fractured Granite: The Mizunami Underground Research Laboratory Site, Japan, *AGU Fall Meeting 2007*, H11-I, speak;

Illman, W. A., A. Craig, **X. Liu**, A. Massi, T.-C. J. Yeh, D. Yin, and J. Zhu, A new paradigm in DNAPL source zone characterization: 3D imaging of contaminant distributions through hydraulic and tracer tomography, *AGU Joint Assembly 2007*, invited speak;

Yin, D., W. A. Illman, **X. Liu**, and A. J. Craig, Hydraulic tomography using temporal moments of drawdown-recovery data: Laboratory sandbox study, *AGU Joint Assembly 2007*, speak;

Walter A. Illman, **Xiaoyi Liu**, and Andrew J. Craig, Steady-State Hydraulic Tomography in a Laboratory Sandbox Aquifer: The Role of Signal-to-Noise Ratio and Conditioning on K Tomograms, *EGU 2007*, speak;

Walter A. Illman, **Xiaoyi Liu**, and Andrew J. Craig, Multi-method and multiscale validation of hydraulic tomography in a laboratory aquifer with deterministic heterogeneity, Society for Industrial and Applied Mathematics (*SIAM*) *Conference on Mathematical & Computational Issues in Geoscience*, March 19-22, 2007, Santa Fe, NM, invited speak;

Walter A. Illman, A. Craig, A. Massi, **X. Liu**, T.-C. J. Yeh, and J. Zhu, DNAPL source zone characterization by the fusion of hydraulic and tracer tomography: Experimental and modeling studies, *SERDP & ESTCP -Partners in Environmental Technology Technical Symposium & Workshop*, November 28 - 30, 2006, Washington DC, poster;

Xiaoyi Liu, Walter A. Illman, Tian-Chyi Jim Yeh, Kenichi Ando, and Shinji Takeuchi, Two- and three-dimensional modeling studies of cross-hole hydraulic tests in fractured granite at Mizunami, Japan, *AGU WPGM 2006*, poster;

Xiaoyi Liu, Walter A. Illman, and Andrew J. Craig, Transient hydraulic tomography in a laboratory sandbox aquifer: Multi-method and multiscale validation of hydraulic conductivity and specific storage tomograms, *AGU WPGM 2006*, speak;

Danting Yin, Walter A. Illman, **Xiaoyi Liu**, and Andrew J. Craig, Laboratory sandbox validation of hydraulic tomography using temporal moments of drawdown recovery data, *AGU WPGM 2006*, poster;

Illman, W. A., A. Craig, **X. Liu**, and D. Yin, Lessons learned from hydraulic tomography in a laboratory aquifer with deterministic heterogeneity, *Hydraulic Tomography Workshop held at Boise State University, Boise, Idaho*, 6/8 - 6/9/2006, invited speak;

Xiaoyi Liu, Walter A. Illman, and Andrew J. Craig, Transient hydraulic tomography in a sandbox with deterministic heterogeneity: Validation of hydraulic conductivity and specific storage tomograms. *AGU Fall Meeting 2005*, poster;

Walter A. Illman, **Xiaoyi Liu**, and Andrew J. Craig, Steady-state hydraulic tomography in a laboratory aquifer with deterministic heterogeneity: Multiscale validation of hydraulic conductivity tomograms. *AGU Fall Meeting 2005*, invited speak;

Andrew J. Craig, Walter A. Illman, and **Xiaoyi Liu**, A Cyclic Sediment Transport Approach to Create a Synthetic Aquifer with Multiscale Heterogeneity. *AGU Fall Meeting 2005*, poster;